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NEW HAMPSHIRE
AGRICULTURAL EXPERIMENT STATION,
DURHAM, N. H.

BULLETIN NO. 17.

STOCK FEEDERS' GUIDE,

WITH

CHART FOR USE IN BARN.

STANDARD GRAIN MIXTURES.
STANDARD RATIONS.

OCTOBER, 1892.

Concord, N. H.:
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NOTICE.

The Agricultural Experiment Station of New Hampshire having been removed from Hanover, N. H., to Durham, N. H., all communications should be directed to the latter place.

The work of laying out the fields and constructing buildings at Durham has prevented the issuing of bulletins, as would otherwise have been done ; but we feel confident that the opportunity for work in new lines in our new home will more than compensate for the unavoidable losses the past year.

The old farm having been sold early the past spring, no field work was possible ; but the dairy work under Professor Wood, and the chemical work under Professor Morse, have given valuable results which will be published within the coming two months, two bulletins being now in the hands of the printer and a third nearly ready.

The work of equipping our new Laboratory, now nearly ready for occupancy, will be forwarded as rapidly as possible, while the field work will be fully laid out for next season.

G. H. WHITCHER,
Director.

STOCK FEEDING.

The subject of winter feeding of live stock is of such vast importance to the farmer that at this time I venture to once more urge every farmer, young or old, to give it careful study; and, in the hope that there are many who would like to test a practical yet scientific method, this Bulletin is sent to about 8,000 New Hampshire farmers, most of whom doubtless own stock of some kind.

It is designed to give plain, practical points which may be adopted, in part, at least, by every farmer, if he is willing to profit by the experience of men whose business it has been to make careful investigation of the principles and laws of stock feeding.

At this point I want to ask every reader of this Bulletin not to throw it aside, and say, "Oh, what is the use of feeding by weight and measure? The old way of feeding is good enough." On the contrary, let me ask you to think for one moment whether or not it is reasonable to suppose that there is room for improvement in this as well as other departments of farm work. How many are there to-day who mow with the hand scythe, rake with the hand rake, reap with the sickle, or thresh with the flail? There has been great improvement in all the mechanical work on the farm; and is n't it reasonable to look for corresponding advancement in the feeding of the cattle? There has been improvement in the practice of farmers in this line, but not in the same degree that the methods of field work have improved. *Farm stock can be fed by rule*, if good judgment is used in carrying out the details. The laying out of a railroad requires a vast amount of work "on paper," theoretical work; but it takes a lot of common sense and practical, every-day shrewdness to decide upon the most feasible route, and to overcome obstacles as they appear. So, in feeding, there are *rules that are reliable*, and are the roads to success; but they are not infallible, and must be used with good judgment.

There are *feeding standards* which tell us how much of the really valuable part of the fodder (*i. e.*, the digestible constituents) is required daily by various classes of stock, and they are based upon actual feeding, and may be depended upon as substantially correct. With these any man may determine for himself what quantity of fuel (that is, food) will be required to get the best results from these living engines which are to produce milk, beef, pork, wool, eggs, etc.

The first step towards profitable feeding, then, is to know the quantity of digestible food required.

The "German Feeding Standards" are of inestimable value to the practical farmer, if only the farmer will make use of them; they give us the daily food required under most of the conditions commonly met with on the farm. The following table is a reprint from Bulletin 4 of this station:

Table A shows the *pounds* of digestible nitrogenous matter (albuminoids) and digestible starchy matter (non-albuminoids) required *daily* for each 1,000 pounds, live weight, of various animals, and the ratio of the former to the latter, known as the Nutritive Ratio.

TABLE A.

1,000 lbs. live weight require daily	Digestible Albuminoids. Lbs.	Non- Albuminoids. Lbs.	Nutritive Ratio.
Oxen at rest.....	0.7	8.37	1 : 12
Oxen working.....	2.4	14.45	1 : 6
Oxen fattening.....	3.0	16.55	1 : 5.5
Cows giving milk.....	2.5	13.50	1 : 5.4
Horses, light work.....	1.8	12.70	1 : 7
Growing cattle.....	2.5	15.00	1 : 6
Sheep, for wool.....	1.2	10.80	1 : 9
Sheep fattening.....	3.0	16.45	1 : 5.5
Hogs fattening.....	4.0	24.00	1 : 6

HOW TO USE THIS TABLE.

The farmer will ask the question, What shall I do with this table? For a concise answer I would say, Use it just as your wife uses her cook book. It gives you the same information relative to feeding a cow that the cook book gives her when she makes cream pie, that is, it tells the amount and kinds of *digestible material* that

a cow *ought* to have to produce good results. It does n't pretend to be the only combination from which good results may be expected any more than Hood's cook book pretends to have the only combination of cooking materials which will make cream pie, but it is based on hundreds of practical feeding experiments, and may be accepted by any farmer as a good, safe, practical guide to work by; and if every milk producing cow in New Hampshire could be fed this winter by this table, there would be an increase of more than one fourth in the milk and butter produced. Now, is n't it worth trying?

ILLUSTRATION SHOWING HOW TO USE TABLE A.

One or two examples will aid those who want to give this matter a trial :

Suppose you have a cow whose live weight is 900 lbs., and are feeding for milk. From the table it appears that a 1,000-lb. cow requires $2\frac{1}{2}$ pounds of albuminoids, and $13\frac{1}{2}$ lbs. of non-albuminoids (starch, sugar, oil, etc.) A 900-lb. cow requires $\frac{9}{10}$ as much. $(2.5 \text{ (albuminoids)} \times 900 = 2,250.0 \div 1,000 = 2.25 \text{ lbs. albuminoids required by cow weighing 900; in the same way } 13.5 \text{ lbs. non-albuminoids} \times 900 = 12,150.0 \div 1,000 = 12.15 \text{ lbs. required.})$ Another example :

Cow weighing 750 lbs. $2.5 \times 750 = 1,875 \div 1,000 = 1.87$ required. $13.5 \times 750 = 10,125 \div 1,000 = 10.12$ required.

The rule then is to multiply the amount found in the table for any kind of animal under consideration, by the live weight, and point off three places (*i. e.*, divide by 1,000).

The live weight of the animal must in most cases be determined by good judgment, but right here let me say that a set of scales in the barn floor is one of the first steps towards successful farming. With this, guesswork gives place to definite knowledge, and farming becomes an interesting occupation. With the means at hand for knowing what is being produced in the field, and what results the fodder produces when fed, a man is in position to make his farm profitable; hence I would say to New Hampshire farmers, Get a set of scales, either three or five tons, and *use them*. The last suggestion is far more important than the first.

Now, having determined what is required daily by one or several animals, we must know how to supply that material in the most readily available and cheapest form. To do this we must know the composition of our feeding stuffs, and chemists have given us table B, which supplies that information.

TABLE B.
FEEDING STUFFS.

1,000 lbs. of, contain.	Digestible.		Nutritive Ratio.
	Albuminoids.	Non- Albuminoids.	
Herdsgrass (timothy) hay.....	3.45	48.71	1 : 14
Redtop hay.....	4.74	48.19	1 : 10
Mixed hay.....	3.71	47.61	1 : 12.8
Mixed hay and clover	4.85	46.40	1 : 9.5
Salt marsh hay.....	2.27	45.83	1 : 20
Clover hay	7.53	43.60	1 : 5.7
Vetch hay.....	9.20	37.67	1 : 4
Oat hay.....	4.85	44.83	1 : 9.2
Winter rye hay.....	10.3	51.7	1 : 5
Millet hay.....	4.67	45.43	1 : 9.7
Rowen.....	6.81	41.74	1 : 6.1
Oat straw.....	1.45	43.31	1 : 30
Bean vines.....	5.00	36.45	1 : 7.3
Corn stover.....	2.15	41.38	1 : 19
Ensilage (Northern corn).....	1.47	14.80	1 : 10
Ensilage (Southern corn).....	1.32	12.73	1 : 9.6
Ensilage (sweet corn).....	1.84	14.92	1 : 8
Pasture grass.....	2.5	10.9	1 : 4.4
Green rye.....	2.00	12.87	1 : 6.4
Potatoes.....	1.42	17.70	1 : 12.4
Sugar beets.....	1.5	7.81	1 : 6.5
Corn and cob meal.....	7.13	66.52	1 : 9.3
Corn meal.....	7.78	71.60	1 : 9.2
Barley meal.....	9.54	65.95	1 : 6.9
Oats, ground.....	9.90	58.16	1 : 5.9
Buckwheat, ground.....	7.7	66.71	1 : 8.7
Linseed (old process).....	28.12	53.21	1 : 1.9
Linseed (new process).....	28.57	44.30	1 : 1.5
Cottonseed meal.....	31.36	42.26	1 : 1.3
Shorts.....	13.26	52.70	1 : 4
Middlings.....	13.35	57.72	1 : 4.3
Gluten.....	25.14	61.90	1 : 2.4
Brewers' grains (wet).....	4.73	16.22	1 : 3.4
Malt sprouts.....	18.36	52.18	1 : 2.8
Cow's milk (whole).....	3.00	14.0	1 : 4.6
Skim milk.....	3.23	6.94	1 : 2.1
Butter milk.....	2.9	4.50	1 : 1.5

HOW TO USE TABLE B.

The feeder who has accepted the fact that his 900-lb. cow requires $2\frac{1}{4}$ lbs. of albuminoids, and $12\frac{1}{2}$ lbs. of non-albuminoids, next wants to supply that amount of food material, and he must make it up out of the fodder he has at hand or can buy; and here I want to say that I do not believe in following the rule blindly, or with the idea that it is absolutely accurate, for such is not the case. It is a good safe guide, and reasonably accurate, and to be followed within reasonable limits, but variations are admissible, and often profitable, since the market price of grains and fodders varies, and hence grains which at one time are most profitable to use at another time may not be; here is where the ingenuity of the individual comes into play. A cow should have from 1 to $1\frac{1}{2}$ per cent. of her live weight daily of hay, and about as much of any coarse fodder like straw, corn-fodder, swale hay, etc. With the present high price of hay, owing to a very short crop, it will prove profitable to use but little over the 1 per cent. If ensilage is used, take 5 per cent. of the live weight.

RATION FOR COW WEIGHING 900.

	Albuminoids.	Non-Albuminoids.
10 lbs. mixed hay furnish.....	0.37 lbs.	4.76 lbs.
10 lbs. corn fodder furnish.....	0.21 lbs.	4.13 lbs.
3 lbs. corn meal (2 quarts).....	0.23 lbs.	1.99 lbs.
3 lbs. cotton seed (2 quarts).....	.97 lbs.	1.26 lbs.
$1\frac{1}{2}$ lbs. gluten (1 quart).....	.37 lbs.	.93 lbs.
Total	2.15 lbs.	13.07 lbs.
Required by standard.....	2.25 lbs.	12.15 lbs.

At present prices this ration would cost about 18 cents, and a trial of this one ration would convince most farmers, I am sure, that it pays to know what we are feeding.

RATION CONTAINING ENSILAGE.

Ensilage, 40 lbs.....	0.60 lbs.	5.6 lbs.
Hay, 5 lbs.....	0.19 lbs.	2.4 lbs.
Middlings, 4 lbs. ($3\frac{1}{2}$ quarts).....	0.54 lbs.	2.3 lbs.
Corn meal, 2 lbs. ($1\frac{1}{2}$ quarts).....	0.14 lbs.	1.3 lbs.
Gluten, 3 lbs. (2 quarts).....	0.76 lbs.	1.8 lbs.
Total.....	2.23 lbs.	13.4 lbs.
Required.....	2.25 lbs.	12.15 lbs.

In each case above given the method of adjusting the ration is simply to decide upon some quantity of hay, say 10 lbs. Now from Table B it will be seen that 100 lbs. of mixed hay contain 3.7 lbs. of albuminoids, and 47.6 lbs. of non-albuminoids, and 10 lbs. would contain 0.37 lb., and 4.76 lbs. as given in ration. The same method holds for other constituents of the ration. The object desired is to get together a combination from the table which shall give a total of digestible albuminoids and non-albuminoids equal to that shown by the feeding standard. There are a few things which must be kept in mind in preparing rations: 1st, there must be bulky fodder, hay, ensilage, or coarse fodders; the rules above given will insure this. 2d, the other constituents must be palatable, and the market price must be taken into consideration as well. It follows then that one of the most important things for the farmer to consider is the kind of grain to buy, for much of the grain that will be fed must be bought.

An important point in figuring a ration is to keep the proportion between albuminoids and non-albuminoids close to the standard of 1 to $5\frac{1}{2}$, though in this country of cheap corn we may with profit make this 1 to 6, or even 1 to $6\frac{1}{2}$; but at once the trouble is seen, if we try to use corn meal in too large quantities, because it is deficient in albuminoids, just as hay and ensilage and corn fodder are; but cotton-seed meal, gluten, middlings, and shorts are all rich in albuminoids, and here is where we must look for something with which to make up the deficiencies of our common fodder. Consequently it will prove more profitable to supplement our home-raised fodders with these highly nitrogenous foods. If for each hundred of corn meal bought farmers would buy one hundred weight of either cotton seed or gluten, and one hundred of middlings or shorts, there would be a great gain in results.

In conclusion, let me ask every reader of this Bulletin to try just for one week a ration like those given, or, what would be better still, figure out one for himself, and see if it pays. Do n't say that rations based on the Feeding Standards are worthless unless you have tried them and found them failures.

Do n't say they are not worth trying; it won't cost you anything to prove for yourself whether or not they are as good or better than the ration you are now feeding.

If the Bulletins of this or any other experiment station are to be of any value to the farmers, it must be by making use of the suggestions which they contain; and I hope that this one may be the means of helping to a better understanding of the principles which govern the feeding of farm animals.

The accompanying chart is designed to be placed in some convenient place *in the barn*. It contains information, tables, etc., which will enable any one to figure out rations with a little study and effort; and its use means better results in nine cases out of ten. Do n't leave it in the house; hang it up where you can see it every time you feed your cattle, and see if you cannot make it worth dollars and cents to you this winter.

The "Standard" mixtures given in the chart have been thoroughly tested, and are known to be well suited to New Hampshire, and by using them the work of the feeder is made easy.

I also reprint from Bulletin No. 4 full instructions for making a balance to weigh hay on. It is simple, not expensive, and does its work to perfection. Let the boys make one and try it.

Or, if a little more expense is not objectionable, buy a dial spring scale; then take six laths, and make a frame similar to the one described in the appendix, using cords to suspend it from the four corners in the same way, cover with coarse cotton cloth, and hang on the hook of the dial scale above mentioned. This is a more convenient form of weighing apparatus, and if any farmer in the state wants such a device, the Station will undertake to furnish them at a cost not to exceed \$2.50 complete, and less if possible. I hope there will be a hundred farmers who will, in some way, provide themselves with the necessary tools for feeding weighed and measured rations this winter, and note the results.

The scale above mentioned can also be used to weigh the milk of each cow, thus enabling any one to know exactly what results are obtained from the use of any particular ration.

STANDARD GRAIN MIXTURES.

No. 1.		No. 2.	
Corn meal,	100 lbs.	Corn meal,	200 lbs.
Middlings,	100 "	Middlings,,	400 "
Cotton-seed,	100 "	Gluten,	300 "

No. 3.		No. 4.	
Corn meal,	300 lbs.	Corn meal,	200 lbs.
Cotton-seed,	300 "	Cotton-seed,	300 "
Gluten,	150 "	Shorts,	300 "
No. 5.		No. 6.	
Gluten,	100 lbs.	Gluten,	100 lbs.
Cotton-seed,	100 "	Cotton-seed,	200 "
Shorts,	100 "	Shorts,	100 "

STANDARD RATIONS FOR COWS WEIGHING 1,000 LBS.

No. 1.		No. 2.	
Hay,	11 lbs.	Hay,	11 lbs.
Corn fodder,	11 "	Corn fodder,	11 "
Grain mixture No. 3, $9\frac{1}{4}$ lbs., or 7 qts.		Grain mixture No. 4, $10\frac{1}{2}$ lbs., or $10\frac{1}{2}$ qts.	
No. 3.		No. 4.	
Hay,	12 lbs.	Hay,	12 lbs.
Oat straw,	8 "	Oat straw,	8 "
Grain mixture No. 3, 9 lbs., or 7 qts.		Grain mixture No. 4, 10 lbs., or 10 qts.	
No. 5.		No. 6.	
Ensilage,	50 lbs., or two bushels.	Ensilage,	50 lbs., or 2 bushels
Hay,	5 lbs.	Hay,	5 lbs.
Grain mixture No. 3, $7\frac{1}{2}$ lbs., or $5\frac{1}{2}$ qts.		Grain mixture No. 4, 8 lbs., or 8 qts.	
No. 7.		No. 8.	
Ensilage,	30 lbs., or five pecks.	Ensilage,	30 lbs., or five pecks.
Hay,	10 lbs.	Hay,	10 lbs.
Grain mixture No. 3, 8 lbs., or 6 qts.		Grain mixture No. 4, 9 lbs., or 9 qts.	
No. 9.		No. 10.	
Ensilage,	40 lbs., or seven pecks.	Ensilage,	50 lbs. or two bushels.
Clover hay,	8 lbs.	Clover hay,	5 lbs.
Grain mixture No. 1, 8 lbs., or 6 qts.		Grain mixture No. 3, 7 lbs., or $5\frac{1}{2}$ qts.	
No. 11.		No. 12.	
Ensilage,	40 lbs., or seven pecks.	Hay,	10 lbs.
Clover hay,	8 lbs.	Straw,	10 "
Grain mixture No. 2, $8\frac{1}{4}$ lbs., or 6 qts.		Grain mixture No. 5, 9 lbs., or 9 qts	

Grain mixtures Nos. 5 and 6 should only be fed with very coarse fodders, like straw, swale hay, corn fodder, etc.

G. H. WHITCHER, *Director*.

APPENDIX.

REPRINT FROM BULLETIN No. 4.

It is difficult for many to weigh hay, corn fodder, straw, etc., for lack of suitable scales, but this is by no means a serious matter; for less than \$1.00 outlay of cash and $\frac{1}{2}$ day's work a balance can be made that will weigh very accurately. The cuts on page 14 represent the parts of one that is now in use in our feeding barn. Figure 1 is the complete balance; A is the beam; a, a, a, are the pivots, which consist of "screw eyes;" b, b, b, are common "halter snaps," which hook into these screw eyes. The cords which suspend the weight platform (W) and the spreader (h) pass through two of these "snaps" while the hook or cord by which the whole is suspended from a beam (d in the cut Fig. 1) is attached to the third "snap." The platform (P) is suspended by its four corners by cords passing *through* the spreader (h) at the parts marked 2, 3; the spreader being suspended by the cord shown passing through holes at 1 and 4. C is a plumb bob suspended from near the top of the beam at n, and when balanced should be in the center of the board x that is fastened to the center of the beam.

The material from which to construct such a balance consists of three "screw eyes" and three "halter snaps;" these may be had at any hardware store, also 40 ft. of window-weight cord and cloth or canvas to cover the hay platform; this is all that need be bought, and the whole cost is only 35 cents.

The beam is made of a straight piece of inch board, 4 inches wide and 8 ft. 6 inches long. This is shown in Fig. 5. On the under side of this, at each end, a piece is cut out, 6 inches long and 2 inches wide, as shown; on the *top* side, in the *exact center*, one screw eye is inserted; now measure *exactly* 4 feet each way from this to

the points y, z, (Fig. 5,) and insert a screw eye at each end on the *under* side, and this completes the beam.

Next get out two pieces, each 1 inch thick, 4 inches wide, and 5 ft. 8 inches long, like Fig. 4, and cut the ends as shown; these are the pieces o, o, which cross in Fig. 2; cross them at right angles and nail securely; now take four laths (t, t, t, t, Fig. 2), cut two of them 4 ft. long, and two 3 ft. 9 inches long. The cross-piece (o) which is *underneath* must have two blocks of inch board, 4 inches square, nailed to each end, to bring the top up even with the other cross-piece. Now nail the laths on as shown. This is the skeleton of the platform, which is to be covered with heavy cotton cloth, or canvas, or oil cloth, tacked to the lath frame; $\frac{3}{8}$ inch holes are bored, one in each corner, and through this the window cord will pass. The spreader (h) is shown on a larger scale in Fig. 6; it is made from a rake stale and is $3\frac{1}{2}$ ft. long; four holes are bored in this, two (1 and 4 in cut) are three inches from the ends, the spreader bail-cord passes through these. The other two are 9 inches from the end, and are at *rightangles* to the two first mentioned; through these (2 and 3 in Fig. 6) the cords which suspend the platform are to pass.

Fig. 3 is simply a piece of inch board, 1 foot square, with holes in each corner. On this platform the weights are to be put. The cuts show how the cords are arranged; where the spreader bale passes through the halter snap it must be tied, so that it cannot slip through the ring of the snap. It is very important that the distance between the center screw eye and the end ones shall be *exactly alike*.

When the whole is completed it may be suspended from a beam in the barn floor by a rope, and if it is desirable this rope may pass through a pulley on the beam, and when the balance is not in use it may be *drawn up* out of the way, being lowered on to the floor when needed.

I was three hours in building the one we are using, and most farmers, or their boys or hired men, can build one without having a carpenter to do the work. The cost will then be less than fifty cents. Surely this sum need not prevent any one knowing what he is feeding.

When the whole is complete two bricks will nearly balance the

hay platform. It then becomes necessary to have weights from which various combinations may be made. Two bricks may be selected that will weigh 4 pounds each ; another may be broken thus getting, by a little chipping, a 2-pound weight ; also a piece can, with a small amount of work, be made to weigh 1 pound. With these, even pounds from 1 to 11 can be made out.

I have just carefully tested the balance we are using and find it sensitive to $\frac{1}{2}$ ounce. The grain rations may be weighed on the same balance or they may be measured. The former is more accurate but not quite as convenient.

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New Hampshire

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